

What is claimed is:

1. A gate valve assembly for providing vacuum isolation between a first treatment system and a second treatment system comprising:
 - an actuator rotatably coupled to at least one of said first treatment system and said second treatment system;
 - an actuator assembly comprising an actuator arm slidably coupled to said actuator, said actuator arm having a distal end;
 - a vacuum feed-through coupled to said actuator assembly and at least one of said first treatment system and said second treatment system, and configured to preserve vacuum with said first treatment system and said second treatment system; and
 - an isolation gate coupled to said distal end of said actuator arm having a gate hinge coupled to at least one of said first treatment system and said second treatment system, and configured to rotate about said gate hinge, wherein a translation of said actuator arm by said actuator causes said isolation gate to rotate about said gate hinge, to close a transfer slot between said first treatment system and said second treatment system, or open said transfer slot between said first treatment system and said second treatment system.
2. The compact gate valve assembly of claim 1, wherein said vacuum feed-through comprises a bellows assembly having a first end plate sealably coupled to said actuator, a second endplate sealably coupled to at least one of said first treatment system and said second treatment system, and a bellows having a first bellows end sealably coupled to said first end plate and a second bellows end sealably coupled to said second end plate.
3. The compact gate valve assembly of claim 1, wherein said actuator comprises a first end and a second end, said second end of said actuator is coupled to at least one of said first treatment system and said second treatment system via a trunion mount.

4. The compact gate valve assembly of claim 1, wherein said distal end of said actuator arm is rotatably coupled to said isolation gate via a pivot hinge.

5. The compact gate valve assembly of claim 1, wherein an extension of said actuator arm from said actuator causes said isolation gate to close and seal said transfer slot between said first treatment system and said second treatment system, and a withdrawal of said actuator arm into said actuator causes said isolation gate to open.

6. The compact gate valve assembly of claim 1, wherein said actuator assembly further comprises a linkage arm having a first linkage end rotatably coupled to said distal end of said actuator arm, a shaft fixedly coupled to a second linkage end on said linkage arm and configured to extend through at least one of said first treatment system and said second treatment system via said vacuum feed-through, and coupled with said gate hinge.

7. The compact gate valve assembly of claim 5, wherein said vacuum feed-through comprises a rotational vacuum feed-through.

8. The compact gate valve assembly of claim 1, wherein a withdrawal of said actuator arm into said actuator causes said isolation gate to close and seal said transfer slot between said first treatment system and said second treatment system, and an extension of said actuator arm from said actuator causes said isolation gate to open.

9. The compact gate valve assembly of claim 1, wherein said actuator assembly further comprises a linkage arm having a first linkage end rotatably coupled to said distal end of said actuator arm, a shaft fixedly coupled to a second linkage end on said linkage arm and configured to extend through at least one of said first treatment system and said second treatment system via said vacuum feed-through, a lever arm having a first lever end fixedly coupled to said shaft and a second lever end having a roller slidably coupled to a roller actuator coupled to said isolation gate.

10. The compact gate valve assembly of claim 9, wherein said vacuum feed-through comprises a rotational vacuum feed-through.

11. The compact gate valve assembly of claim 9, wherein a withdrawal of said actuator arm into said actuator causes said isolation gate to close and seal said transfer slot between said first treatment system and said second treatment system, and an extension of said actuator arm from said actuator causes said isolation gate to open.

12. A method of operating a compact gate valve assembly for providing vacuum isolation between a first treatment system and a second treatment system comprising:

translating an actuator assembly using an actuator rotatably coupled to at least one of said first treatment system and said second treatment system, wherein said actuator assembly comprises an actuator arm slidably coupled to said actuator configured to extend through a vacuum feed-through coupled to said actuator assembly and at least one of said first treatment system and said second treatment system, and couple with an isolation gate having a gate hinge coupled to at least one of said first treatment system and said second treatment system; and

rotating said isolation gate about said gate hinge in a first direction to close a transfer slot between said first treatment system and said second treatment system, and in a second direction opposing said first direction to open said transfer slot.

13. A method of operating a compact gate valve assembly for providing vacuum isolation between a first treatment system and a second treatment system comprising:

translating an actuator assembly using an actuator rotatably coupled to at least one of said first treatment system and said second treatment system, wherein said actuator assembly comprises an actuator arm slidably coupled to said actuator, a linkage arm having a first linkage end rotatably coupled to a distal end of said actuator arm, a shaft fixedly coupled to a second linkage

end on said linkage arm and configured to extend through at least one of said first treatment system and said second treatment system via a vacuum feed-through, an isolation gate having a gate hinge, and a lever arm having a first lever end fixedly coupled to said shaft and a second lever end having a roller slidably coupled to a roller actuator coupled to said isolation gate; and

rotating said isolation gate about said gate hinge in a first direction to close a transfer slot between said first treatment system and said second treatment system, and in a second direction opposing said first direction to open said transfer slot.

14. A method of operating a compact ~~gate~~ valve assembly for providing vacuum isolation between a first treatment system and a second treatment system comprising:

translating an actuator assembly using an actuator rotatably coupled to at least one of said first treatment system and said second treatment system, wherein said actuator assembly comprises an actuator arm slidably coupled to said actuator, a shaft fixedly coupled to a distal end of said actuator arm and configured to extend through at least one of said first treatment system and said second treatment system via a vacuum feed-through, and an isolation gate having a gate hinge fixedly coupled to said shaft; and

rotating said isolation gate about said gate hinge in a first direction to close a transfer slot between said first treatment system and said second treatment system, and in a second direction opposing said first direction to open said transfer slot.